

**Rising Above The Gathering Storm:  
Energizing and Employing America for a  
Brighter Economic Future**

**Statement of**

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Retired Chairman and Chief Executive Officer  
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**And**

**Member, Committee on Prospering in the Global Economy of the 21<sup>st</sup>  
Century  
Committee on Science, Engineering, and Public Policy  
Division on Policy and Global Affairs  
The National Academies**

**before the**

**Committee on Science  
U.S. House of Representatives**

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Mr. Chairman and members of the Committee.

Thank you for this opportunity to appear before you on behalf of the National Academies' Committee on Prospering in the Global Economy of the 21<sup>st</sup> Century. As you know, our effort was sponsored by the National Academy of Sciences, National Academy of Engineering and Institute of Medicine (collectively known as the National Academies). The National Academies were chartered by Congress in 1863 to advise the government on matters of science and technology.

Mr. Augustine, chair of the committee, has discussed the overall concerns the committee has about the future vitality of the United States economy. During my testimony, I will focus on the problems that we're having in K through 12 education. The committee believes the education issue is the most critical challenge the United States is facing if our children and grandchildren are to inherit ever-greater opportunities for high-quality, high-paying jobs—and our solution and recommendations to respond to the nation's challenge in K—12 science, mathematics, engineering, and technology education were the committee's top priority.

The committee found that the American public is not satisfied with the K through 12 education available for their children. They are worried about the international comparative surveys that show that children outside the United States—even those in countries with far less resources than ours—rank higher than their own children in their understanding of mathematics or science.

The committee then made the recommendation we call “10,000 teachers, 10 million minds” which proposes increasing America's talent pool by vastly improving K—12 science and mathematics education.

In developing its action steps to reach this goal, the committee first focused on what part of K—12 science, mathematics, engineering, and technology education was of greatest concern. The committee immediately recognized that many of these teachers do not have sufficient education in these fields, and its recommendations respond to that concern.

Of all its action steps, the committee's highest priority is a program that would annually recruit 10,000 of America's brightest students to the science, mathematics, and technology K–12 teaching profession. The program would recruit and train excellent teachers by providing scholarships to students obtaining bachelor's degrees in the physical or life sciences, engineering, or mathematics to gain concurrent certification as K–12 science and mathematics teachers. Over their careers, each of these teachers would educate 1,000 students, so that each annual cadre of teachers educated in this program would impact 10 million minds.

The program would provide merit-based scholarships of up to \$20,000 a year for 4 years for qualified educational expenses, including tuition and fees, and would require a commitment to 5 years of service in public K–12 schools. A \$10,000 annual bonus would go to program graduates working in underserved schools in inner cities and rural areas.

To provide the highest-quality education for undergraduates who want to become K–12 science and mathematics teachers, it would be important to award matching grants, perhaps \$1 million a year for up to 5 years, to as many as 100 universities and colleges to encourage them to establish integrated 4-year undergraduate programs leading to bachelor's degrees in science, engineering, or mathematics *with concurrent teacher certification*.

This program, modeled after a very successful program in Texas (and which is being replicated in California), takes advantage of those people who are already in science, mathematics, engineering, and technology higher education programs and offer them the ability to get into teaching. It also incorporates in-classroom teaching experiences, master K-12 teachers, and ongoing mentoring—the combination of which produces highly qualified teachers with the skills and support to remain effective in the classroom.

Our second action step focuses on strengthening the skills of 250,000 current K–12 science and mathematics teachers through summer institutes, Master's programs, and Advanced Placement and International Baccalaureate (AP and IB) professional development programs. Each of these activities also builds on very successful model programs that can be scaled up to the national level.

In the case of the summer institutes, the committee recommends that the federal government provide matching grants for state-wide and regional 1- to 2-week summer institutes to upgrade the content knowledge and pedagogy skills of as many as 50,000 practicing teachers each summer. The

material covered would allow teachers to keep current with recent developments in science, mathematics, and technology and allow for the exchange of best teaching practices. The Merck Institute for Science Education is a model for this recommendation.

For the science and mathematics master's programs, the committee recommends that the federal government provide grants to universities to develop and offer 50,000 current middle-school and high-school science, mathematics, and technology teachers (with or without undergraduate science, mathematics, or engineering degrees) 2-year, part-time master's degree programs that focus on rigorous science and mathematics content and pedagogy. The model for this recommendation is the University of Pennsylvania Science Teachers Institute.

In the case of AP, IB, and pre-AP or pre-IB training, the committee recommends that the federal government support the training of an additional 70,000 AP or IB and 80,000 pre-AP or pre-IB instructors to teach advanced courses in mathematics and science. Assuming satisfactory performance, teachers may receive incentive payments of up to \$2000 per year, as well as \$100 for each student who passes an AP or IB exam in mathematics or science. There are two models for this program: the Advanced Placement Incentive Program and Laying the Foundation, a pre-AP program.

The committee also proposes that high-quality teaching be fostered with world-class curricula, standards, and assessments of student learning. Here, the committee recommends that the Department of Education convene a national panel to collect, evaluate, and develop rigorous K–12 materials that would be available free of charge as a *voluntary* national curriculum. The model for this recommendation is the Project Lead the Way pre-engineering courseware.

Why are we doing this? Because, as Mr. Augustine mentions, many of the teachers who are teaching subjects have no background in the subjects that they are teaching. It is very hard for someone who does not have a physics education to turn students on to physics, because they have no basic feeling for the subject. Teachers with strong content knowledge, either through a bachelors or Masters program, who also have strong pedagogy skills and access to ongoing skills updates can be truly effective at

encouraging students in science, mathematics, and technology fields. That is the thesis that we've built on.

The committee also proposes a program that will enlarge the pipeline by encouraging more students to take AP and IB science and mathematics courses and tests through providing more opportunities and incentives for middle-school and high-school students to pursue advanced work in science and mathematics. The committee suggests a national goal of increasing the number of students in AP and IB mathematics and science courses from 1.2 million to 4.5 million, and setting a goal of tripling the number who pass those tests, to 700,000, by 2010. Student incentives for success would include 50% examination fee rebates and \$100 mini-scholarships for each passing score on an AP or IB mathematics and science examination.

The reason we are encouraging more students to participate in AP/IB courses is because we have found, through the Dallas-based AP Incentive Program, that those students who take AP/IB courses are twice as likely to enter and complete college as those who do not. Of particular interest is the ability of programs such as the University of California College Prep Program to reach currently underserved areas or populations of students with specific learning needs through online access to teachers and tutors.

We also propose scholarships for American undergraduates who are willing to go into science and technology and engineering and fellowship programs for those pursuing graduate science and engineering degrees in areas of national need.

In sum, the committee is proposing a whole spectrum of recommendations that will enhance the quality of science, mathematics, engineering, and technology education for all American students and providing incentives for Americans to pursue higher education degrees in these fields. By taking the proposed actions, we believe that the United States will be better positioned to compete as a country for future high knowledge jobs.

Thank you for providing me with this opportunity to testify before the committee. I would be pleased to answer any questions you have about the report.

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Dr. Vagelos served as Chief Executive Officer of Merck & Co. Inc., for nine years from July 1985 to June 1994. He was first elected to the Board of Directors in 1984 and served as its Chairman from April 1986 to November 1994.

Dr. Vagelos joined the worldwide health products firm in 1975 as Senior Vice President of Research and became president of its research division in 1976; in addition, starting in January 1982, he served as Senior Vice President of Merck with responsibility for strategic planning. He continued to hold both positions until 1984, when he was elected Executive Vice President.

Before assuming broader responsibilities of business leadership, Dr. Vagelos had won scientific recognition as an authority on lipids and enzymes and as a research manager. This followed a decision early in his career to put his principal energies into research rather than the practice of medicine.

Dr. Vagelos received a A.B. degree (1950) from the University of Pennsylvania, where he was elected to Phi Beta Kappa, the academic honor society. He received his M.D. from Columbia University (1954) and was elected to Alpha Omega Alpha, the medical honor society. After internship and residency (1954-56) at Massachusetts General Hospital in Boston, he joined the National Institutes of Health in Bethesda, Maryland.

At the NIH (1956-66) he served in the National Heart Institute, holding positions in cellular physiology and biochemistry—first as Senior Surgeon and then as Head of Section of Comparative Biochemistry, both in the Laboratory of Biochemistry.

In 1966, Dr. Vagelos joined Washington University in St. Louis, Missouri, as Chairman of the Department of Biological Chemistry of the School of Medicine. In addition, from 1973 to 1975, he assumed more extensive responsibilities as Director of the University's Division of Biology and Biochemical Sciences, which he founded.

Dr. Vagelos has received honorary Doctor of Science degrees from Washington University (1980) for his research achievements and important influence on national science policy; Brown University (1982) for distinguished contributions to the advancement of knowledge as a teacher, research scientist, and head of one of the nation's outstanding laboratories; the University of Medicine and Dentistry of New Jersey (1984) for outstanding leadership in biomedical research leading to drugs and other therapeutic agents of direct benefits to mankind; New York University (1989) for contributions in helping to discover and produce medicines that both extend and enhance life; Columbia University (1990) for an extraordinary range of accomplishments in biological science, pharmaceutical research, and leadership in the pharmaceutical industry; the New Jersey Institute of Technology (1992) for his contributions to medical research; Pamukkale University in Turkey (1992); and the University of New York at Stony Brook (1994) for outstanding achievement; Mount Sinai Medical School (1997); and the University of British Columbia (1998). He received Honorary Doctor of Laws degrees for leadership in the battle to conquer diseases from Princeton University (1990), the University of Pennsylvania (1999) and Harvard University (2003). Rutgers University (1991) granted him honorary Doctor of Humane Letters degree in recognition of his "ambitious agenda to develop effective cures for the most perplexing illness of our time."

The author of more than 100 scientific papers, he received the Enzyme Chemistry Award of the American Chemical Society in 1967. He was elected in 1972 to the American Academy of Arts and Sciences and the National Academy of Sciences, and in 1993 to the American Philosophical Society. In 1989 he received the Thomas Alva Edison Sciences Award from Governor Thomas Kean. In 1993, he received the Lawrence A. Wien Prize in Social Responsibility from Columbia University. In 1994 he received the C. Walter Nichols Award from New York University's Stern School of Business. In 1995 he received the National Academy of Science Award for Chemistry in Service to Society. In 1998 he was awarded the Prince Mahidol Award conferred by His Majesty the King in Bangkok (Thailand). In 1999 he received the Othmer Gold Medal from the Chemical Heritage Foundation and Bower Award in Business Leadership from Franklin Institute.

Dr. Vagelos was Chairman of the Board of Trustees of the University of Pennsylvania from October 1994 to June 1999, having served as a trustee since 1988. He also served as Co-Chairman of the New Jersey Performing

Arts Center from 1989-99, was President and CEO of the American School of Classical Studies at Athens from 1999-2001 and served in the National Research Council Committee on Science and Technology for Countering Terrorism in 2002.

He is currently Chairman of Regeneron Pharmaceuticals, Inc. and Theravance, Inc., two biotech companies. He is also Chairman of the Board of Visitors at Columbia University Medical Center where he also chairs the Capital Campaign. He serves on a number of public policy and advisory boards, including the Donald Danforth Plant Science Center and the Danforth Foundation.

Dr. Vagelos is married to the former Diana Touliatos. They live in New Jersey, and have four children and seven grandchildren.

Dr. Vagelos was born on October 8, 1929, in Westfield New Jersey.